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Factors influencing the likelihood of regulatory changes in renewable electricity policies

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Abstract

The renewable electricity literature has expanded in recent years from the analysis of policies focused on Research and Development (R&D) and off-grid deployment to the discussion of policies introduced to facilitate the diffusion of renewable electricity in the mainstream market. This article contributes to the discussion of renewable electricity policies by analysing some of the factors influencing the occurrence of regulatory changes, i.e. the financial sustainability and economic effectiveness of the policies, the allocation of costs and benefits; the coherence of the policies; the size and variety of the coalitions supporting and opposing renewable electricity; and the ‘‘Brussels effect’’. The importance of these factors is evaluated in the case of three major markets of renewable electricity: Germany, the Netherlands and Denmark.

Keywords: Renewable electricity policy; Regulatory change; Feed-in law; Tradable green certificates

Contents

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1. Introduction

Mirroring the development of renewable technologies from laboratories to the market place, the renewable electricity literature has expanded from the analysis of policies focused on R&D and deployment in off-grid applications [1–3] to the discussion of policies aimed at facilitating the diffusion of renewable electricity in the mainstream market. Although R&D policies are still thoroughly analysed [4,5], significant penetration rates experienced in some countries and less successful deployment in others have attracted the attention of academics and policy analysts—see for example Blok [6] and the papers in this special issue.

Recently, much consideration has been devoted to the importance of the risks faced by renewable generators in OECD electricity markets. According to Foxon et al. [7] the real and perceived risks preventing renewable technologies from large-scale deployment are related to the development to large scale of any relatively new technology; to the fact that these technologies can be brought forward by market-based instrument (market risk); to the fact that some of these technologies are likely to be "disruptive", i.e. have a significant effect on the configuration of energy systems; and finally to the fact that renewable markets are created by policy mechanisms subject to changes in policy priorities and governments. The term regulatory risk is given by Foxon et al. [7] to the last type of risk. An analogous focus on risk in the analysis of renewable electricity can be found in Wiser et al. [8]. The authors distinguish among risks related to the price of fuel; to its availability; to the demand for electricity; to the compliance with environmental legislation; to the fact that generators may not be able to deliver the agreed quantity of electricity; and finally to the fact that the benefits or burdens of a contract can be altered by existing regulations or renegotiation [8, p. 338].

A similarly detailed level of analysis is adopted in Mitchell et al. [9]. The authors distinguish between price, volume and balancing risk, which in the framework described in Foxon et al. [7] would be grouped in the so-called market risk. Mitchell et al. [9] use this taxonomy to evaluate the effectiveness of the renewable electricity policies introduced in England and Wales, i.e. the Renewable Obligation, and in Germany, i.e. the Renewable Energy Act. The authors show that risk reduction is an important criterion in evaluating support mechanisms for renewable electricity. In fact, the German feed-in tariff is more effective at increasing generating capacity than the English and Welsh policy because the latter fails to reduce the risks borne by renewable generators.

Other authors have analysed the importance of risks for renewable electricity from the point of view of investors. Examples of articles of interest are Ingersoll et al. [10] which analyses risk management in the context of PV generation, Biffoni et al. [11] which considers how risk management influences the prospects for decentralised generators in liberalised energy markets and Bond and Carter [12] which discusses the strategies used to manage risk in developing countries. Incidentally, it should be noticed that when analysing renewable electricity from an investor's perspective, authors need to be careful about the approach used to determine the profitability. In fact, Awerbuch [13] argues that the cost of renewable electricity differs substantially if one uses finance models instead of the more standard levelised cost approach. Analysing the effects of renewable policies from an investor's perceptive contributes to the opening of the black box between policy and policy results [14]. In order to achieve this aim, one need to carefully assess the design of the policy and its influence on variables of interests (see for example [15,16]) and also take into account the different objectives, motivations, risk-aversion and financial possibilities of different typologies of investors [17,18]. When choosing the support system for renewable electricity, policy makers need to acknowledge that different economic instruments or even different designs of a particular economic instrument affect the profitability of the various types of investors in a dissimilar way [14].

While looking at the regulatory changes in renewable electricity policies in three European countries, this paper takes a somewhat different approach from the investor's perspective discussed above. In fact, this paper assesses some of the factors influencing the occurrence of a regulatory change and the extent to which regulatory changes can explain sudden variations in the diffusion of renewable electricity. The analysis in this paper does not open the black box between policy and policy results, as advocated in Dinica [14], and is clearly conducted at the macro level, i.e. observing the additional generating capacity in a country and the occurrence or the discussion of a regulatory change in the policy arena. The attention is focused exclusively on potential regulatory changes; neither the other risks faced by the renewable generators nor their interaction with regulatory changes are discussed. Although this is maybe a limitation, the synergetic effect of multiple factors on the diffusion of renewable electricity can be analysed only after assessing the importance of each single element.

It is also important to mention that this article focuses on regulatory changes in those policies which have been explicitly introduced to affect the development of renewable electricity generation. Policies which improve the competitive position of renewable electricity while achieving another main objective, e.g. an energy tax from which renewable electricity is exempt, have not been considered. Several taxonomies have been presented in the literature for renewable electricity policies. Readers not familiar with this field are referred to the discussion in Ackermann et al. [19], Hvelplund [20,21] and Meyer [22]. Throughout the article, regulatory changes improving or expected to improve the financial conditions of renewable generators are called "positive regulatory changes", while those worsening or expected to worsen the generators' profitability are called "negative regulatory changes". After considering the effects of regulatory changes faced by renewable generators (Section 2), the factors likely to influence the occurrence of a regulatory change in the renewable electricity policies are discussed (Section 3). Finally, the importance of these factors is analysed in relation to the renewable electricity policies in Germany, Denmark and the Netherlands (Section 4).

2. Effects of regulatory changes

It is difficult to assess the effects of regulatory changes without discussing them in detail. In fact, as long as the political will exists to support renewable electricity, the profitability of the plants may be left unaffected or even be improved when changes occur. In other words, the financial implications of policy changes for the generators (and not only the changes themselves) are of paramount importance for investors. Nevertheless, regulatory changes might have at least two detrimental effects on the introduction of renewable technologies regardless of the financial implications for generators. If the benefits from investments in renewable electricity can be altered, investors might be unwilling to commit to projects for fear of sustaining a loss if the policy is changed. Because of this uncertainty, investors may forego opportunities with positive net present value. This is an example of what in economics is called hold-up problem ([23], p. 136-139). In short, after carrying out the investment, generators lose bargaining power because capital goods cannot be put to any other use. The effect of regulatory instability on the willingness of investors to commit to long-term projects has been thoroughly discussed. Dinica and Arentsen [24] for example conclude that "potential developers who chose not to invest [in the Netherlands] might have been discouraged by the frequent and unpredictable changes in the fiscal and financial instruments used by the government". Not surprisingly, policy stability has become increasingly important in persuading the financial community and utilities to invest in renewable technologies [25,26]. While revenues of the plants already built have often been shielded when altering renewable electricity policies, this insurance is normally not granted in the case of changes occurring in other types of regulation.

Even when future changes in the regulation do not affect existing plants, they may have a harmful impact on the diffusion of renewable technologies. In the past, when a negative regulatory change was announced, generators have often been given the opportunity of being remunerated according to the existing policy, provided they built plants or obtained planning permissions before a certain deadline. Not surprisingly, when the financial treatment under the new policy was expected to deteriorate, investors significantly increased their efforts to build plants or obtain permits. A policy periodically characterised by this sort of behaviour is the Production Tax Credit (PTC) in the United States. As discussed in Bird et al. [27], this policy has caused a boom-bust cycle of development in the wind industry—see Fig. 1. Annual additions of wind generating capacity boomed in the years when the credit was scheduled to expire (i.e., 1999, 2001, and 2003) while in the off years development lagged. It would seem logical to conclude that such an unstable interest in renewable technologies puts unneeded strain on the industry providing material inputs and expertise, and in some cases it could prevent its development. In fact, this is what occurred in England and Wales. The NFFO, a policy comprising competitive bidding rounds held between 1990 and 1998, failed to promote a domestic manufacturing industry due to the fierce price competition and lack of certainty [29,30]. Mitchell [30] concludes that the NFFO has effectively supported wind turbines manufacturing in countries other than its own.

3. Factors influencing the occurrence of regulatory changes

The effectiveness of the policy introduced to stimulate the diffusion of renewable electricity would seem important in determining the occurrence of regulatory changes. In

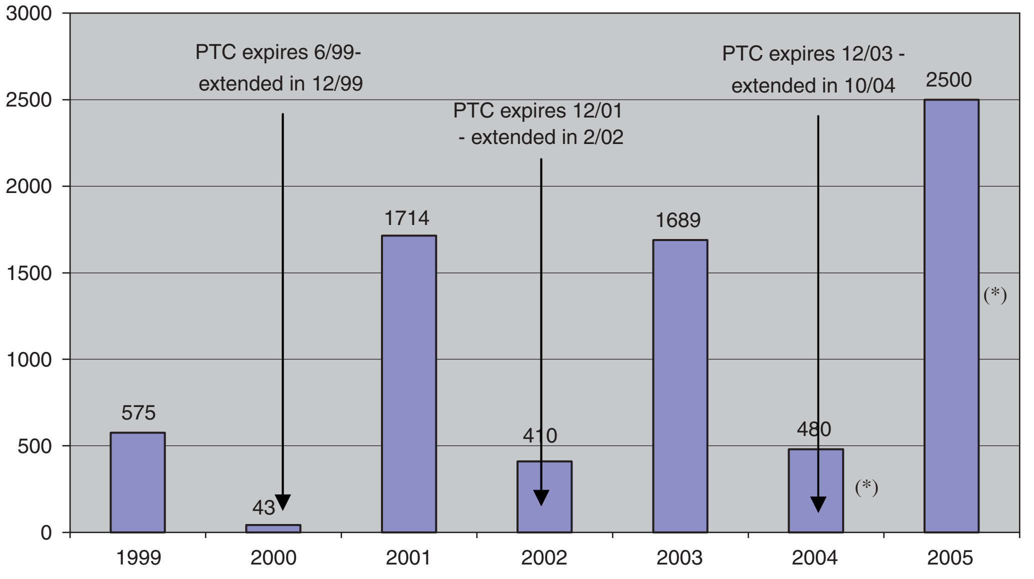

Fig. 1. US Wind Power Capacity Additions (1999–2005) in Megawatts (MW) (*) indicates industry estimates. Source: Anon [28] from data by American Wind Energy Association.

fact, governments should not have many incentives to alter policies which increase the renewable share in the electricity system if this was the purpose for which they were introduced. The problem in this truism is related to the fact that the parameters used to assess the effectiveness of the policy are unclear. The amount of capacity (kW) or electricity (kWh) added by the policy is an obvious candidate, although it is unlikely to be the only relevant criterion. For example, the costs per kW or kWh are likely to be other important factors. Not only there is a plurality of criteria to assess the effectiveness of a policy but also different actors inside the governments are likely to have varying points of view on the importance of particular criteria. Because it seems difficult to draw an objective judgement on the effectiveness of a policy aimed at increasing the amount of renewable electricity, this criterion has not been used in the paper to foresee the occurrence of a regulatory change. However, it can be argued that policies failing the criteria below, especially those presented in Sections 3.1–3.3, are unlikely to be effective. In other words, although not explicitly discussed, the effectiveness of a policy is taken into account by discussing the factors influencing the extent to which a policy is able to deliver.

It is worth mentioning that the choice of the criteria discussed in the rest of this section has been influenced by the survey and assessment of renewable policies in three European Countries: Denmark, Germany and the Netherlands. Extensive presentation of the author's understanding of the policies in these countries can be found in Agnolucci [31]; Agnolucci [32] and Agnolucci [33]. Needless to say, the factors below are not meant to be the "definitive" list; other policy analysts would most likely have produced a different set of criteria based on their own assessment of the policies and events. However, the author of this article believes that the factors discussed below had a great deal of influence in preventing or facilitating regulatory changes in the three countries mentioned above.

3.1. Financial sustainability and economic efficiency

Regardless of the electricity or generation capacity delivered, a regulatory change would seem likely to occur when renewable electricity policies fail to be financially sustainable or reach a certain degree of economic efficiency. While the absence of these two features on their own might not be responsible for a regulatory change, policies which fail to be financially sustainable or economically efficient are scarcely defensible when attacked by interest groups hostile to them. Financial sustainability is particularly important for policy instruments requiring payments to generators from the government budget. Considering the competition for public money among different causes (e.g. health, education, environment, social security, etc.), renewable electricity policies imposing an unsustainable burden on the finances of the government are likely to undergo a regulatory change. Conversely, when the payments to renewable generators are funded by a large set of economic actors, e.g. from the electricity consumers' bills, renewable policies might be more long-lived even when they are not particularly efficient or impose a considerable financial burden. In fact, as the share of the subsidies paid by each actor will be negligible compared to their disposable income, very few of them are likely to feel the urgency to lobby for a regulatory change. With regard to the direction of the change, a policy failing to be financially sustainable is likely to cause a negative regulatory change. However, one can also foresee a positive regulatory change when a policy funded through the central budget becomes founded by a large body of economic actors.

3.2. Allocation of economic costs and benefits

Similarly to the lack of financial sustainability and economic efficiency, the allocation of economic costs and benefits will influence the way in which interest groups relate to the policy, in particular those who are bearing a large share of the costs or are given a small fraction of the benefits. As the environmental benefits of renewable electricity are public goods,[1] it seems odd to require a particular set of actors to bear most of the burden [35]. In addition, it would seem counterproductive not to allow all potential investors in renewable electricity to compete on equal terms. In fact, an uneven treatment of different parties might add strength to the groups trying to hinder the diffusion of renewable electricity. While renewable polices need to discriminate by default between renewable and other electricity sources, they should prevent, as far as possible, discrimination among actors who are willing to invest in renewable technologies. This is particularly important in the case of utilities, as these actors can hinder the connection of independent generators to the grid or give them contracts with unfavourable terms. At the same time, a policy giving the same financial terms to all types of investors is likely to cause energy utilities and large corporations to dominate the renewable market. This may have repercussions on the diversity and composition of the lobby group and on the acceptance of local communities of renewable projects, since utilities and corporations will be perceived as external actors who are motivated only by pecuniary reasons. As small companies often face substantial

[1]This should be intended in economic terms. In economics, a good (bad) is called public good (bad) when it is not rival—one person's consumption of the good (bad) does not diminish the amount of the good (bad) available for others to consume—and not excludable—it is very difficult, if not impossible to prevent exclude a certain set o consumers from consuming the good (bad), if they wish so [34, p. 78–83].

barriers to obtaining funds to enter the renewable market, policies like soft loans should be considered instruments to create equal opportunities among different generators and not concessions to a certain set of investors.

3.3. Coherence of the policy

Renewable policies should also be coherent with the broader institutional and policy landscape. In fact, coherent policies make full use of the economic incentives introduced to stimulate investment and are less likely to be changed because they do not hinder the achievement of other objectives pursued by the government. It should be mentioned that the coherence of renewable policies should be assessed in relation to specific circumstances, and not in general terms. In fact, both tradable green quotas and feed-in laws can be incoherent depending on the institutional setting in which they are introduced.

It is desirable that renewable policies be coherent with at least the electricity market and the environmental and planning regulations. Lack of coherence with the regulation in the electricity market might decrease the interest of utilities in renewable generation, although this will only affect the price paid to generators when price determination is left to buyers and sellers. Lack of coherence with environmental regulations, in particular with those in the carbon market, can increase the instability of renewable policies. The fact that the price of a tonne of CO_2 on the carbon market is, say, £10 while cutting a tonne of CO_2 through the adoption of renewable electricity costs, say, treble might bring about a negative regulatory change. In fact, it might be challenging for the renewable lobby to justify the existence of such high economic incentives paid to generators. On the other hand, there are a number of reasons (see footnote 2) for dealing with renewable electricity separately from the carbon market. In practical terms, renewable electricity is unlikely to be deployed if funded exclusively by a low carbon price. It is also true that while the currently high cost of renewable electricity will decline as the deployment increases (learning curve effect), the currently lower cost of energy efficiency measures is likely to increase in the future. Finally, coherence with the planning system is needed to ensure that permissions are granted in a smooth and timely fashion. This is particularly important for utilities companies and corporations that are unused to working at the grassroots level. While planning systems should not bypass the will of local communities, the existence of a lengthy and opaque allocation of permissions increases the risk borne by potential generators and raises the returns on investment needed to attract investors to the field.

3.4. Supporting and opposing coalitions

The commitment of the government influences both the occurrence of a regulatory change and the way in which the financial conditions of renewable generators are altered. It is important to stress that changes in the government are particularly important in determining the occurrence of regulatory changes. As discussed in the case studies, a number of regulatory changes occurred after new governments were sworn in. The intensions of the government can be augmented (as in Germany) or hindered (as in Denmark) by the size and variety of the coalition (inside and outside the government) supporting renewable electricity. Size has per se an ambiguous effect on lobbying. When the size of lobbying coalitions increases, some actors could have an incentive to free-ride on the efforts put in by the other members, although this is much less likely to happen

when the behaviour of different economic actors can be monitored. Hence, it would seem likely that the presence of an organised and well-established coalition supporting renewable electricity and of supportive governmental departments is a powerful factor hindering (fostering) negative (positive) regulatory changes. In addition, the presence of an effective network of policy advocates and decision makers influences the resilience of the renewable industry, in the sense that by guaranteeing the stability of the policy, it acts as a safety net for single investors.

It is worth mentioning that in addition to coalitions supporting renewable electricity there also exist coalitions of opponents, sometimes comprising utilities and ministries of economic affairs or industry. Because the two coalitions will be lobbying for opposite aims, the variety of the actors with a stake in renewable electricity can be important in explaining the lack of negative regulatory changes or the occurrence of positive ones. Diversity can contribute to increasing the connectivity of the supporting coalition, i.e. the number of linkages between the private sector and the public components. A diverse set of actors in the renewable coalition, e.g. comprising unionised workers, networks of professionals, farmers and investors, may gain the attention of different parts of the executive power. In this case it will be more difficult for the lobbying group opposing renewable electricity to influence members of the ministries of economic affairs and industry. This is more likely to happen when the socio-economic benefits from renewable sources would be missed, if only a carbon tax or a CO_2 tradable quota were introduced.[2] An exclusive focus on the reduction of greenhouse gas emissions is unlikely to be a very good strategy because those benefits on their own do not warrant any privileged status to renewables compared to other CO_2 cutting measures.

It should be mentioned that in some instances coalitions supporting a specific technology could act to the detriment of other technologies. After all, different technology-specific associations might end up competing for the limited amount of political capital and financial funds which are devoted to renewables. As far as the author of this article is aware, a detailed analysis of the relationships between the associations supporting different renewable technologies has never been attempted in the literature. Although the extent of any competition should be evaluated on a case-by-case basis, the size of technology-specific associations is likely to influence the decisions taken by the more general renewable coalition. Associations of technologies closer to economic competitiveness with fossil fuel electricity, e.g. wind, are also more likely to be influential with policy makers, as these technologies will play an important role in achieving the objectives of the policy, at least in the short-term. Nonetheless, the future potential held by a particular technology will also be important, as testified by the growing support for PV among policy makers.

3.5. The brussels effect

Another factor influencing regulatory changes in renewable electricity policies is related to the policy development in Brussels and has therefore been dubbed the ‘‘Brussels effect’’.

[2]According to IEA [36], the deployment of renewable electricity technologies in OECD countries can create a number of socio-economic benefits in addition to the environmental ones. In particular, these technologies can contribute to energy diversity and security, generate income from the export of new technology, provide a considerable source of employment; and maintain sustained levels of rural population.

Quite interestingly, the introduction and the withdrawal of proposals for tradable quota schemes by a number of European states mirrored the discussion held in Brussels on the harmonisation of national policies to support renewable electricity. According to Lauber [37], the system based on green certificates was strongly favoured by the European Commission and by some member states until the end of 1999, on the grounds that competition among generators would reduce the rates and increase efficiency. However, when the Energy Commissioner submitted a draft advocating the renewable electricity directive based on certificates, he was forced to withdraw his proposal. The second draft and the adopted directive were neutral with regard to the choice of instruments used by the governments of member states to promote the diffusion of renewable electricity.

4. Empirical relevance of the factors influencing regulatory changes

The importance of the factors discussed above is evaluated in the case of three major renewable electricity markets: Germany, the Netherlands and Denmark. As it is not possible to discuss in any detail the policies in these countries or present the timeline of regulatory changes, readers not familiar with this field are referred to the papers under the "further reading" section in the references.

4.1. The Netherlands

The numerous policies introduced in the Netherlands offer an interesting example for the discussion of the factors mentioned in the previous section.[3] It is fair to say that the policies until 1995 had only a limited success in delivering additional generating capacity. In Fig. 2a, one can see that the renewable industry was dominated by wind while biomass waste incineration delivered sudden surges, notably in 1993 and 1996, mainly due to the introduction of more stringent waste regulations and high landfill taxes. However, as this generating technology depends on the production of waste, its growth potential is limited; by 1997 about three quarters of the waste was already being incinerated [39].

It is interesting to note that the increase in additional wind generating capacity in 1995 was due to a negative regulatory change. When the government announced the introduction of a new production subsidy and of an energy tax (the REB tax) from which renewables would be exempt, a number of entrepreneurs managed to overcome obstacles to the diffusion of renewable plants, notably planning requirements. At the announcement of this regulatory change, investors were let known that plants realised by 31st December 1995 would receive the subsidies prescribed by the old policy. According to Agterbosch et al. [17], investors exploited the the looming regulatory change in order to increase pressure on local authorities granting permits. As described in Section 2, the announcement of a negative regulatory change can deliver a sudden surge in the additional generating capacity. In fact, the economic conditions for wind investors strongly deteriorated in the first 2 years after the introduction of the new policy [17, p. 2055].

[3]Due to the numerous regulatory changes, authors are used to distinguishing a number of periods in the Dutch regulatory setting. For example, Agterbosch et al. [17] distinguish between the monopoly, the so-called interbellum and the free market period; Dinica and Arentsen [38] differentiate among the voluntary, the financial and the mandatory models; while Agnolucci [33] divides the evolution of the regulatory system into a technology push, a voluntary, a mixed (supply–demand) and a supply period.

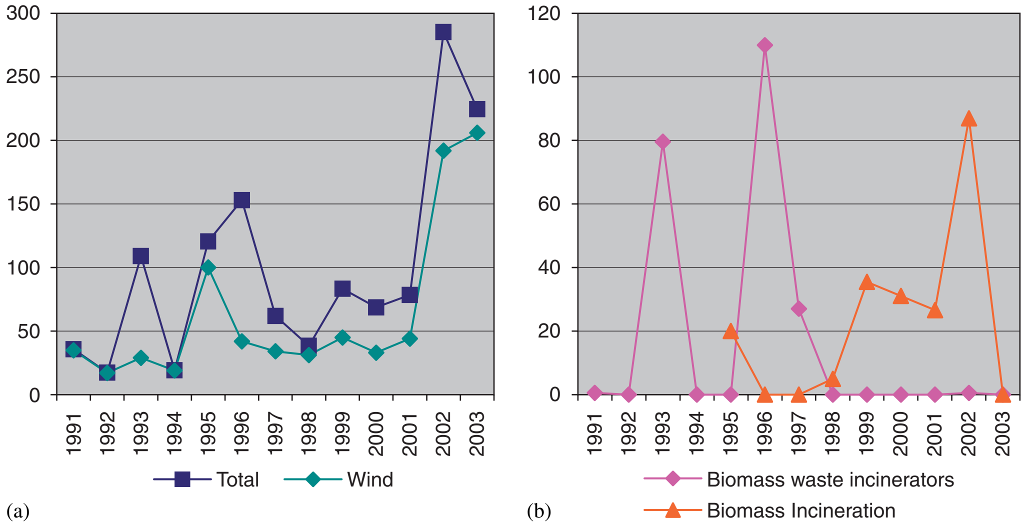

Fig. 2. (a). Additional generating capacity in MW. Source: Statistics Netherlands (2004), (b). Additional generating capacity in MW. Source: Statistics Netherlands (2004).

Among those discussed in Section 3, probably the most important factors influencing the diffusion of renewable electricity policies in the Netherlands have been the lack of coherence and the lack of a strong coalition supporting renewable electricity. An example of the former is provided by the government announcement of a plan—and related subsidies—to reach 1000 MW of wind capacity by 2000. However, after the introduction of such a bold objective, the siting of turbines in the first part of the nineties was hindered by local authorities reluctant to grant planning permission. According to Stenzel et al. [40], the government attempted to resolve this issue by finding an agreement with provincial authorities, although planning licences were granted by local authorities which saw few benefits from wind plants. Another example of lack of coherence is provided by the agreement which was signed in 1997 between the utilities and the government to deliver 1700 GWh of renewable electricity by 2000. The considerable level of uncertainty which was endured by generators was related to the role of foreign renewable electricity. The voluntary target in the agreement was to be verified by using Green Labels, i.e. certificates that were also used to grant exemption for the REB tax and related production subsidy. As foreign renewable electricity qualified for these two policies, there was an expectation that imports could also be counted towards the achievement of the voluntary target. The wording of the target was ambiguous, as it referred to the domestic supply of renewable electricity and not to its production, the obvious difference between the two being the quantity imported. When uncertainty was finally tackled in 2000, it was clearly too late and the target was missed by a considerable margin [24]. A final example of the lack of coherence of renewable electricity policies is provided by the surge of the demand for green electricity in 2001. According to van der Heule [39], this was a fortuitous occurrence and not the effect of planned action by the government. In fact, the increase in the REB exemption from 3.72 Euro cent/kWh to 5.83 in 2001 and 6.01 in 2002 was motivated by fiscal reasons. Analogously, the early opening of the renewable electricity market to

competition in July 2001 was not motivated by environmental objectives. In fact, the green electricity was singled out to allow utilities to experiment with market liberalisation introduced by the European Directive 96/92/EC. The green market was opened three years earlier than the brown market because of its relatively little importance—at the time—to utilities. However, due to the sudden increase in the demand for renewable electricity, imports in 2001 reached about 7500 GWh from 1500 in the previous year [41] while domestic production stagnated.

The examples of lack of coherence described above are likely to have decreased the additional generating capacity which could have been delivered by the renewable electricity policies [24] and also facilitated the occurrence of regulatory changes. However, with regard to the latter effect, lack of coherence always played a role together with some of the other factors mentioned in Section 3. For example, in the case of the imports of renewable electricity mentioned above, regulatory change was inevitable when the policy became financially unsustainable and economically inefficient. Because of the REB exemption and the green certificates, introduced in 2001, also granted to imported renewables, the government had to forego a considerable amount of revenues while receiving very few benefits. The exemption was a windfall for existing European renewable plants which would have made a profit anyway. In addition, the production incentive comprised in the REB was being paid almost entirely to the company managing the Dutch–German interconnector [42]. As the interconnector was congested, the spot price of brown electricity might have risen because of the decrease in import elasticity.[4] Not surprisingly, in 2002 the REB exemption was decreased and the production subsidy was substituted by a feed-in tariff; only Dutch generators were made eligible for this policy. It is worth mentioning that this overhaul of the renewable policy followed the constitution of a new Cabinet. The new executive announced almost immediately its intention to change the law. In February 2002, the outflow of tax revenues and the lack of long-term price certainty for domestic investors were identified as obstacles to achieving long-term targets [43]. The Brussels effect also played a role in this regulatory change. Although the previous Dutch government adopted tradable green certificates, the then preferred instrument in Brussels, the openness of the system to imports produced inefficient cross-border trades. In fact, economic incentives caused a redirection of renewable electricity from foreign markets to the Dutch one without any substantial increase in capacity at home or abroad [43]. Eventually, after Brussels considered the harmonisation of the support instruments a less pressing issue and dropped its hostility to feed-in tariffs [37], the new Dutch government introduced a feed-in instrument.

The lack of coherence of renewable electricity policies and the consequent regulatory uncertainty are also likely to have prevented the formation of a strong coalition supporting renewable electricity which could have made negative regulatory changes, or changes which were perceived as such, more difficult to implement. For example, in the case of the voluntary agreement signed between utilities and the government for the delivery of 1700 GWh of renewable electricity by 2000, the uncertainty relating to the treatment of

[4]The REB exemption did not bring about an increase in the price of the interconnector capacity as the policy required utilities to balance sales and purchase of green electricity only in monthly terms. Hence, utilities could buy the nearly zero-valued off-peak interconnector capacity. In the case of the production subsidy, as utilities had to show a contract path from the source to the point of delivery, including the use of import capacity on all borders, they were forced to buy peak capacity [42].

foreign renewable electricity could have been quickly resolved if the government had been pressed to clarify this issue by influential renewables organisations. Also the green certificates, i.e. the policy introduced straight after the expiration of the voluntary agreement, were suddenly affected by a negative regulatory change. The green certificates were introduced in July 2001 to verify the REB exemption and were initially given only to national generators. However, six months later imported renewables were brought into the scheme. Although this was mainly caused by pressure from Brussels to reach the target in the EU Renewables Directive [24], the existence of an influential coalition could have prevented the occurrence of such a change. On the other hand, considering the past performance of national renewable generators the government felt that imported renewable electricity was needed to increase the supply of renewable electricity.

4.2. Germany

In Germany, the allocation of economic costs and benefits among potential investors and the strength of the coalition supporting renewable electricity have been the main sources of regulatory changes. Since its introduction, the first feed-in law (STrEG) which was submitted by two MPs from the Northern Laender was biased in favour of wind and hydropower. The STrEG was originally conceived to support mainly a few hundred MW of small hydropower (Bechberger 2000 quoted in [44]). However, it found keen supporters in the northern German states. Lauber [37] reports that because of liberalisation and declining markets, German agriculture was looking for new opportunities to earn additional income. In Northern Germany wind power was perceived as one of such opportunities. Considering the generating costs of renewable sources and the tariffs in the feed-in law—90% of the electricity price for wind and solar and 80% for biomass and small hydropower plants [58]—one can conclude that only wind and small hydropower were made competitive by the policy. The effect of the policy on hydropower can be seen in Fig. 3b. However, after the capacity of hydropower was more or less exhausted, wind has been largely responsible for the increase in renewable generating capacity. As can be seen in Fig. 3a, until 1999 the total additional generating capacity closely tracked that of wind. Although the expansions of wind electricity might have prevented other renewable sources from attracting the funding needed to become competitive (as briefly discussed in Section 3.4) no contribution in the literature has voiced this point of view.

While windmills owners received much of the benefits from the STrEG, utilities owning the electric grid to which wind plants were connected had to bear the costs while the plants owned by these utilities were not eligible for this scheme [46]. In addition, the different quality of wind across Germany caused utilities from the northern German states to pay a larger share than that paid by utilities in the relatively windless South [47]. As long as the electricity market was composed of regional monopolies, this disparity of treatment could be passed on. At the end it was the captive customers of the northern utilities who were funding much of deployment of wind electricity through higher electricity price. On the other hand, the same citizens of the northern German states were reaping the benefits in terms of industrial growth and employment in a promising technology and cleaner air. As soon as the regional monopolies were abolished and utilities from the North had to compete with those from the South, the allocation of the tariffs paid to wind generators became a serious issue. In fact, one of the reasons motivating the first major regulatory change in the feed-in law was the desire of the government to address the unbalance in the

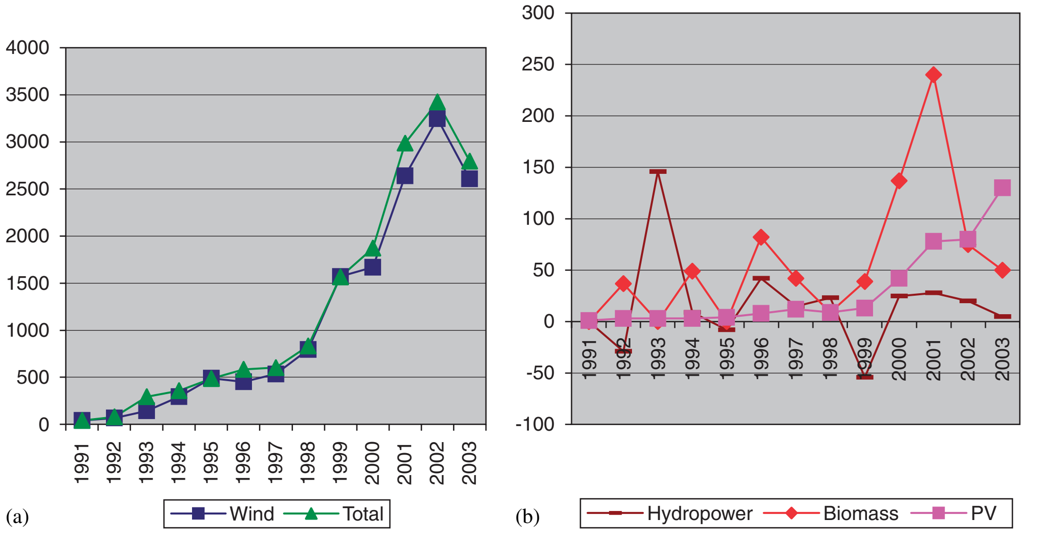

Fig. 3. (a) Additional generating capacity in MW. Source: BMU [45]. (b) Additional generating capacity in MW. Source: BMU [45].

financial burden imposed by the policy. When the government introduced the so-called hardship clause in 1998, utilities' obligation to take renewable electricity was limited to 5% of the electricity delivered in their area (Hoogland and Schaeffer 1999; [35]). By introducing the clause the government hoped to temper the opposition of utilities and remove obstacles to the diffusion of renewables. In the meantime, the first cases brought in front of the courts by utilities had reached the Federal Constitutional Court and Federal High Court in 1996. Although the feed-in law caused disagreement and criticism since its introduction, the argument of the cases through the courts mentioned above marked a new low point in the relationship between utilities and wind generators (Grotz 2002). Uncertainty regarding the future of the scheme explains the stagnation of additional capacity observed in 1996 and 1997, as one can see from Fig. 3a.

The allocation of costs and benefits of renewable electricity in the StrEGg was completely readdressed by the new policy introduced in 2000, the Renewable Energy Act (EEG). A change was widely expected after the Red–Green coalition was elected in 1998. Reduced hostility from utilities was achieved through the introduction of a nationwide mechanism so that the amount of feed-in tariffs paid by each utility is proportional to the electricity sold. In addition, utilities are now being given the opportunity to build plants. Analogously, the allocation of benefits across renewable technology was addressed by granting tariffs which are related to generating costs. As one can see in Fig. 3b, the introduction of the Renewable Energy Act in 2000 has allowed the development of PV and, partially, of biomass.

With regard to the supporting coalition, it is interesting to note that Germany has always had a fairly diverse set of actors with a stake in renewable electricity. For example, although the StrEG was submitted by two MPs from the Northern Länder, at the end it was supported by all political parties, although there was some confrontation with the government and the parliamentary party leaders of the government coalition. Jacobsson

and Lauber [44] conclude that passing the law did not require a large political effort. The federal structure of Germany allowed northern politicians to be very supportive of wind generators as they were seen as an important group of constituents. While at the introduction of the StrEG farmers were one of the main beneficiaries from the scheme, the development of a national wind industry added another set of stakeholders to the supporting coalition. This group was very likely related to a network of policy-makers very different from that of farmers and environmentalists. Finally, by stimulating growth in the use of biomass and PV, the Renewable Energy Act has further enlarged the coalition supporting renewable electricity. The addition of PV owners is likely to have been an important change: annual additions to generating capacity of 150 MW, the level observed in 2003, imply that about 50,000 new members join the coalition supporting renewable electricity every year (the peak capacity of the average system is about 3.5 kWp [48]).

Instances where the renewable electricity coalition has been important in decreasing the regulatory risk have been very numerous in Germany. First of all, one of the reasons stimulating the change from the StrEG to the Renewable Energy Act was the fact that the electricity price was substantially falling due to the liberalization of the market and excess of generating capacity [47]. The Red–Green coalition not only increased the rate paid to renewable generators but also eliminated the price risk borne by generators by separating the determination of the tariffs from the price in the electricity market and by guaranteeing rates for 20 years. It should be mentioned that the StrEG was also amended because the hardship clause was a highly inefficient mechanism, as the windy sites from the regions above the 5% threshold were to be discarded in favour of less productive sites located in the regions below the threshold. However, the fact that the Renewable Energy Act increased the rates and eliminated a clause constraining the development of wind generators points to the importance of the coalition supporting renewable electricity and of the much more proactive stance of the new government.

Another example of the importance of the renewable electricity coalition is provided by the biennial revision process incorporated to ensure that the tariffs in the Renewable Energy Act track the evolution of costs. The first round of this procedure lasted about two years, i.e. from August 2002 to June 2004, and has been characterised by some relatively sterile confrontation between the two houses of the German Parliament. The changes in terms of rates, eligibility and length of the scheme have been considerable from the start of the process to its end [31,49]. Despite the lengthy period of instability and uncertainty brought about by this amendment, additional wind generating capacity managed to reach about 2.5 GW in 2003. As discussed in Section 3.4, it is likely that single investors went ahead with their investments, as their interests would be taken into account through effective lobbying from the supporting coalition.

The coalition supporting renewable electricity has also been extremely important in resisting the Brussels effect. Despite the perseverance of two European energy commissioners and the preference of the European Commission for tradable quotas, Germany and its wind industry managed to make the political framework more and more favourable to the feed-in approach [37]. A review of the German feed-in law was initiated in 1999 but after the European court ruled in favour of the feed-in law in 2001, DG Competition's threats became less pressing. On May 2002 the European Commission had to state that the German laws did not constitute a state aid. Although in 2000, additional generating capacity markedly slowed down—see Fig. 3a—the strength of the coalition supporting renewable electricity managed to resist the attacks from Brussels and

successfully retained their preferred policy instrument. While most countries have now adopted feed-in laws, the German policy has recently come under attack from the utility association VDEW [50]. The new Chancellor has voiced support for a quota-based system [51], although no clear statement has been presented as official party policy [52]. It is worth pointing out that heated exchanges over the Renewable Energy Act also emerged from time to time in the previous Red–Green government coalition, in particular between the Economics and the Environment Ministries [53]. As the renewable industry is clearly opposing a policy change [51], the strength of the coalition supporting renewable electricity in Germany might soon be tested if the Chancellor intends to amend the Renewable Energy Act.

4.3. Denmark

In the case of Denmark, the shifts in the balance of power of the coalitions supporting and opposing renewable electricity has maybe been the most important factor explaining the occurrence of regulatory changes. Denmark has been a pioneer in the renewable electricity field; incentives paid to these sources date back to 1979. When in 1984 the parliament wanted to pass legislation favourable to turbine owners, the utilities negotiated a 10-year "voluntary" agreement [37]. However, a feed-in tariff was introduced in 1992, when the agreement between utilities and renewable generators collapsed. Nonetheless, at the beginning of the scheme, Danish utilities hindered the implementation of the policy and created a climate of uncertainty that restrained investors' enthusiasm for renewable electricity. As can be seen from Fig. 4, the wind additional generating capacity in 1992–1994 was about 40 MW compared to about 75 MW/year in 1988–1991 (DWIA, 2002). The turning point occurred in 1995–1996 due to the new government, the merger of the environmental and energy ministries and to the appointment of a minister with views sympathetic to renewable generators [37]. These events considerably strengthened the coalition supporting wind electricity which finally managed to ensure a clear implementation of the feed-in law.

However, the position of the government changed after the boom in wind electricity during the second part of the nineties. In March 1999 the government announced the termination of the feed-in law, the introduction of a green certificate based obligation to buy a certain share of renewable electricity and the introduction of a transitional agreement for existing plants and for those bought or receiving planning permission by December 1999. This regulatory change, which was perceived to undermine the financial profitability of windmills, was supported by all political parties. However, the wind industry association managed to obtain much better terms for the turbines covered by the transitional scheme than for those covered by the new policy.[5] The looming negative regulatory changes caused the surge in additional generating observed in 2000, as investors rushed to obtain permits before the end of 1999, although most of the turbines were actually built in 2000 [55]. However, in December 1999, it became clear that preparations were nowhere near completion and the introduction of the new policy was postponed to

[5]It is fair to say that the Danish Wind Industry Association was moderately satisfied about the outcome of the negotiations. According to its President, although "turbine manufacturers faced radically changed market conditions [.] things did not look too good in the spring of 1999", i.e. at the beginning of the negotiations. At the end the Danish wind industry "seem[ed] to have landed on [its own] feet" DWIA [54].

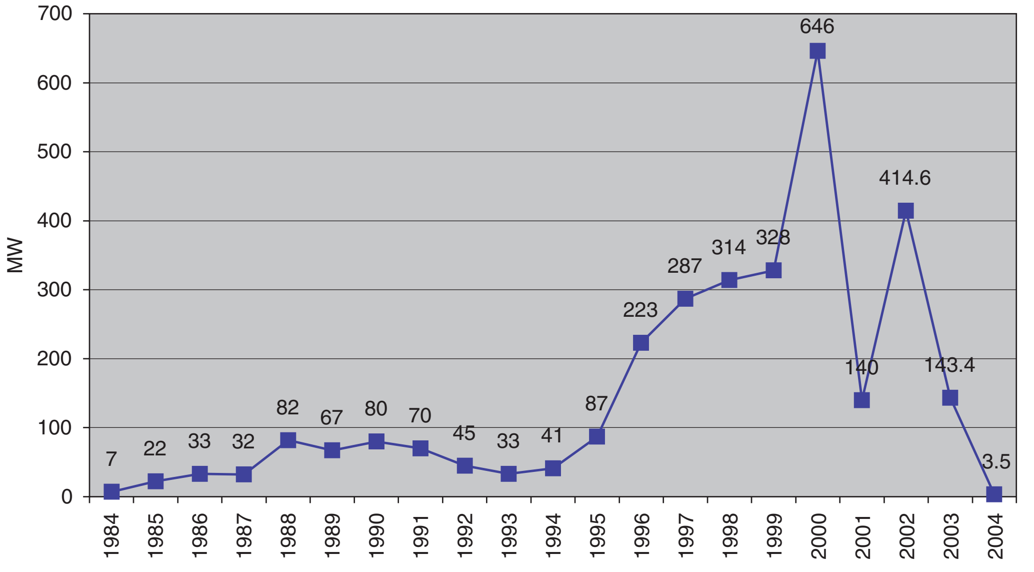

Fig. 4. Wind additional generating capacity. Source: DWIA (2002).

January 2002 [54]. Preparations for the implementation were somewhat slow and the scheme was again postponed to January 2003. Eventually, in June 2002 the Minister for the Environment and Energy shelved the plans for the certificate scheme. Renewable generators would be paid a small premium rate and a scrap premium if new onshore turbines substituted old and obsolete windmills. While the strong renewable coalition managed to secure good conditions for the turbines covered by the transitional scheme, the change in the government which occurred in November 2001 shifted the balance of power between the coalition supporting renewable electricity and that opposing it. The results of a government clearly less sensitive to the environmental issues [56], can be seen in Fig. 4: from several hundred MW of annually installed wind power in the period 1996–2003, new installations fell to 4 MW in 2004. Provisional figures for 2005 seem to confirm a standstill in the deployment of wind electricity in Denmark. The policy introduced after the green certificate scheme was shelved offers even worse economic conditions than the green certificates.

It should be mentioned that the lengthy period of regulatory uncertainty described above originated in 1998 because of the lack of financial sustainability of the feed-in law. The increase in wind generating capacity stimulated by the policy—from 87 MW in 1995 to 328 MW in 1999—implied a surge in the production incentive paid to renewable generators. In fact, in 1999 the government paid as much as 90 million Euros [57] and had to forego the revenues from the CO_2 tax which was refunded to renewable generators. As mentioned in Section 3.1, when renewable electricity policies imply a considerable amount of payments from central budget, they are very prone to being amended. Also the Brussels effect influenced the development of renewable policies in Denmark. In fact, if the financial sustainability of the policy had been the only concern of the government, an allocation system like the one introduced in Germany by the Renewable Energy Act (see Section 4.2) would have been adequate or, alternatively, the feed-in tariffs could have been

passed on to consumers. The proposal to drop the feed-in law and introduce green certificates was influenced by the fact that the European Commission in 1999 had a strong preference for the latter as the system to harmonise the diffusion of renewable electricity in the Member States. The lengthy implementation of the policy change in Denmark was influenced by the confrontation between the German wind industry and the European Commission. While the buoyant Danish wind industry could have benefited from a pan-European green certificate market—as certificates "produced" in Denmark could have been sold across Europe—there was no particular benefit for the Danish industry if the scheme had to be implemented only in Denmark. After the European Commission stated in May 2002 that the German law did not constitute state-aid, it took the Danish government just a month to shelve its plans for the certificate scheme. By then the idea of a European market for certificates had considerably lost momentum.

5. Conclusions

This paper has discussed some of the factors influencing the occurrence of regulatory changes in renewable electricity policies and evaluated the importance of these factors in three of the major European markets. Regulatory changes are affected by the economic efficiency and financial sustainability of the policy; the way in which costs and benefits are allocated among the parties; the coherence of the policy with the wider institutional setting; and by the size and composition of the coalitions supporting and opposing the deployment of renewable electricity. When renewable electricity policies are not financially sustainable or coherent with the wider institutional setting, it is easier for the coalition opposing the deployment of renewable electricity to attack these policies. While the allocation of costs and benefits arising from renewable electricity policies determines the composition of the coalitions, the most important single factor influencing the effectiveness of the lobbying coalitions is the stance taken by the government. As was discussed in the article, several regulatory changes occurred after a change in the executive power, although the reasons prompting these changes had been building up for some time. Despite the prominence of the government, the size and the variety of the coalitions are important factors in facilitating or hindering the commitment of the government. Finally, it was noticed that national policies have been very sensitive to the debate held in Brussels about the instrument to promote renewable electricity, i.e. the Brussels effect. As this caused various changes and a lengthy period of uncertainty, the next round of discussions should be carefully organised in order to avoid so many changes in national policies. It is worth mentioning that regulatory changes and the risk they cause can slow down the achievement of the targets introduced by the governments to increase the deployment of renewable electricity. It is in the best interests of consumers and governments alike to minimise this kind of risk.

Dutch renewable generators have been exposed to several policy changes because a strong coalition supporting renewable electricity was lacking while the government failed to articulate a coherent policy in the renewable market. As a result, the demand for green electricity boomed while national supply lagged behind. At the end, a feed-in law for Dutch generators was only introduced because most of the generous economic incentives paid previously by the government were being spent on already existing foreign plants or to buy capacity on the Dutch–German interconnector. In Germany the feed-in law introduced in the early nineties failed to stimulate the investment in biomass and PV and

caused hostility from utilities. In fact, these actors were obliged to pay the costs of the policy without being able to benefit themselves from the tariffs. When unstable solutions such as the hardship clause were introduced, only the strength of the coalition supporting renewable electricity could ensure a growing level of additional capacity. The coalition supporting renewable electricity was clearly strengthened by the election of the Red–Green government in 1998. The German renewable industry has also been able to resist the pressures from Brussels on the use of tradable quotas. The future policy development is unclear, as the new Chancellor has voiced in the past some support for renewable quotas. Nevertheless, she seems unlikely to push through a sudden regulatory change due to the economic importance of the renewable industry—in particular wind and PV—and to the existence of a coalition government. Finally, the development of wind policies in Denmark has been influenced by the economic importance and lobbying power of the wind industry and by the debate in Brussels. Although the implementation of the scheme proposed by the European Commission and opposed by the wind industry was finally abandoned, the formation of the new right-wing government radically changed the balance of power between the coalition opposing and that supporting renewable electricity. In fact, the additional wind generating capacity has been brought to a standstill in the last couple of years.

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